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EXAMINER	
UHLIR, NIKOLAS J	
ART UNIT	**PAPER NUMBER**
1773	

DATE MAILED: 03/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/812,515	Applicant(s) MUKAI ET AL.	
	Examiner Nikolas J. Uhlir	Art Unit 1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 December 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,13 and 21-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,13 and 21-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to the amendment/arguments dated 12/18/2003. Applicant's amendment to claim 13 is sufficient to overcome the previous objection to the claim. Accordingly, this objection is withdrawn. Currently, claims 1-6, 13, and 21-25 are pending.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims, 1-4, 21-22, and 24-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lal et al. (US5580667) in view of Bertero et al. (US6150015).

4. Claim 1 requires a layered polycrystalline structure comprising a seed crystal layer containing a non-magnetic element; a magnetic crystal layer containing a non-magnetic element diffused along a grain boundary, said magnetic layer at least partly excluding a non -magnetic element out of a lattice of the magnetic crystal layer; and a non-magnetic crystal layer between the seed crystal layer and the magnetic crystal layer, wherein the non-magnetic crystal layer contains a non-magnetic element at a first concentration level near the seed crystal layer and at a second concentration level smaller than the first concentration level near the magnetic layer.

5. It is noted that the requirement, "said magnetic layer at least partly excludes a non-magnetic element out of a lattice of the magnetic crystal layer," is read on by any magnetic layer. The requirement that the layer "at least partly exclude" a non-magnetic element merely requires "some" of "any" non-magnetic element to not be present in the

lattice of the magnetic layer. Thus, even if a magnetic layer were comprised of only magnetic elements, i.e. a pure Co layer, it would still read on this claim requirement because it at least partly excludes every known non-magnetic element.

6. Bearing this interpretation in mind, Lal et al. (Lal) teaches a magnetic recording medium comprising a substrate 22, and a sputtered crystalline underlayer 24, a gradient layer 25, and a first magnetic layer 30 formed in this order from the substrate (figure 1 and column 3, line 55-column 4, line 3). The sputtered crystalline underlayer is made of Cr (column 4 lines 19-25) and is considered by the examiner to be equivalent to the applicants claimed seed crystal layer containing a non-magnetic element. The magnetic layer 30 is a Co based alloy that comprises an alloy of Co with one or more of the elements Ni, Pt, Nb, Cr, Ta, V, W, B, Zr, Si, Hf, and P, with exemplary alloys including CoCrTa, CoCrPt, CoCrNi, CoCrTaPt, CoCrTaNi, CoCrTaPtB, and CoNiPt (column 4, lines 36-50). The gradient layer at the boundary of the Cr underlayer and the Co based magnetic layer exhibits an axial composition gradient, wherein the gradient layer contains progressively more of the alloy composition of the magnetic layer and progressively less of the underlayer Cr metal as the film progresses in the direction from the Cr underlayer to the magnetic layer. It is the examiners position at some portion of this gradient layer is equivalent to applicants claimed non-magnetic crystal layer, as the layer progresses from pure crystalline Cr at the boundary between the Cr underlayer and the gradient layer (Cr is known to be non-magnetic) to pure Co based magnetic alloy at the boundary between the gradient layer and the magnetic layer. Thus, the gradient layer necessarily possesses an area that contains a large amount of Cr

(equivalent to applicants claimed first concentration level) near the underlayer, and contains progressively less Cr as the layer approaches the Co based magnetic layer.

7. However, Lal does not teach that non-magnetic element is diffused along the grain boundary of the magnetic layer, as required by claim 1.

8. With respect to this deficiency, Bertero et al. (Bertero) teaches that the signal to noise ratio of a magnetic layer can be improved by segregating the crystal magnetic grains with a segregant material, such as a Cr (column 2, lines 4-10).

9. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a CoCr based alloy as the magnetic layer in Lal, such that the Cr in the alloy segregates the magnetic crystal grains.

10. One would have been motivated to make this modification in light of the teaching in Bertero that the signal to noise ratio of a magnetic layer can be improved by segregating the crystal grains in the layer with a non-magnetic material such as Cr. One would have specifically selected a CoCr based alloy as the Co based magnetic layer of Lal in light of the fact that Lal recognizes the equivalence of CoCr alloys to the other materials listed as suitable for forming the magnetic layer.

11. Claim 2 requires the seed crystal layer to contain Cr in an amount of ≥50 atomic %, the magnetic layer to comprise a Co based alloy having Cr atoms diffused in the grain boundary, said Co-based alloy magnetic crystal layer at least partly excluding Cr atoms out of a lattice of the magnetic crystal layer; and the non-magnetic layer to comprise a Co based alloy non-magnetic crystal layer containing Cr atoms at a first

concentration nears the seed layer and a second concentration smaller then the 1st concentration near the magnetic layer.

12. It is noted that the limitation "at least partly excluding Cr atoms out of a lattice of the magnetic crystal layer" does not require the any portion of the magnetic layer to "completely" exclude Cr atoms. Thus, this limitation is read on by a CoCr containing magnetic alloy layer wherein at least some Cr is segregated out at the grain boundary, even if some Cr remains in every portion of the magnetic layer.

13. Bearing this interpretation in mind, the limitations of claim 2 are met as set forth above for claim 1.

14. Claim 3 requires the seed layer to be pure Cr. This limitation is met as set forth above for claim 1.

15. Claim 4 requires the same limitations as claim 1, except for the recitation that the structure is a magnetic recording medium. These limitations are met as set forth above for claim 1.

16. Claim 6 requires a Ti layer to be defined along the surface of the substrate. Lal teaches that a metal layer is preferably formed on the substrate prior to forming the Cr underlayer. The metal layer is typically formed form Ti, V, W, Si, Mo, Nb, Ag, B, Al, Gd, or Ni/P, with Ti being preferred (column 5, line 63-column 6, line 5).

17. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a Ti layer between the substrate and the Cr underlayer taught by Lal.

18. One would have been motivated to select Ti for this purpose as Lal recognizes Ti to be equivalent to the other materials listed as suitable for forming this layer.

19. Claim 21 requires the magnetic crystal layer to have crystal grains equal to the size of the grains in the non-magnetic layer. Although Lal does not expressly teach this limitation, Bertero teaches that a sputtered magnetic layer in a magnetic recording medium epitaxially grows over the grains of the layer upon which it is deposited. Thus, the size of the magnetic grains is controlled by the size of the underlayer grains (column 14, lines 1-27). Thus, in light of the teaching that the grains of the magnetic layer epitaxially grow over the grains of the nucleation layer, and that the grain size of the nucleation layer controls the grain size of the magnetic layer, the examiner takes the position that the magnetic layer grains in Lal will be of equal size to that of the gradient layer grains. Thus, the limitations of claim 21 are met.

20. Claim 22 requires the non-magnetic crystal layer to have an epitaxial relationship to the seed layer. As established above for claim 21, sputtered deposited layers in magnetic recording media epitaxially grow over crystalline layers upon which the sputter deposited layer is deposited. Thus, the examiner takes the position that this limitation is met, although it is not expressly taught.

21. Claim 24 requires the non-magnetic crystal layer to have a concentration gradient of the non-magnetic element from the first concentration level to the second concentration level. This limitation is met as set forth above for claim 1.

22. Claim 25 requires the magnetic element to contain the non-magnetic element at a concentration level equal to the second concentration level along the grain boundary.

Although this limitation is not expressly taught, Bertero teaches that grains in a CoCr based alloy magnetic layer are segregated by "excess Cr" in the alloy (column 14, lines 1-7). Lal teaches that the gradient layer contains progressively more Co based alloy and progressively less Cr from the underlayer as the layer progresses away form the underlayer (column 4, lines 25-35). Therefore, the excess Cr in the alloy magnetic layer at the point at which the magnetic layer and the gradient layer meet will logically be the amount of chromium from the underlayer remaining in the upper portion (second area) of the gradient layer. Thus, as Bertero clearly teaches that "excess Cr" in the alloy separates the grains in a CoCr based alloy, it is the examiners position that the amount of Cr in the grain boundaries of the Co based magnetic layer will be equivalent to the amount of Cr in the upper portion of the gradient layer. Thus, the limitations of claim 25 are met.

23. Claims 5, 13, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lal in view of Bertero as applied to claim 1 above, and further in view of Okumura et al. (US5700593).

24. Lal as modified by Bertero above fails to teach the limitation in claim 5 requiring an amorphous layer to be formed between the substrate and the seedlayer.

25. With respect to this deficiency, Okumura et al. teaches that the crystal grains of a magnetic recording medium can be refined by forming a non-magnetic amorphous metal layer on the surface of a substrate prior to the deposition of any other non-magnetic or magnetic layers (column 2, lines 38-65). Suitable materials for forming the

non-magnetic amorphous layer include pure Cr, pure V, pure Ti, or a Cr, V, or Ti alloy having an alloy composition providing an amorphous structure (column 4, lines 15-20).

26. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to form a non-magnetic amorphous Ti layer as taught by Okumura et al. between the substrate and the Cr underlayer utilized by Lal as modified by Bertero.

27. One would have been motivated to make this modification due to the teaching in Okumura et al. that the grain size of a magnetic recording medium can be improved through the deposition of a non-magnetic amorphous layer on the surface of a substrate prior to the deposition of other magnetic or non-magnetic layers. One would have specifically been motivated to choose Ti as the non-magnetic amorphous material due to the teaching of the equivalence of Ti to the other materials listed as suitable for use as the amorphous non-magnetic crystal layer by Okumura et al. Further, a Ti coating is listed by Lal as a preferred material for coating a substrate prior to coating the Cr underlayer.

28. Claim 13 requires a layered polycrystalline structure comprising amorphous nucleation sites physically separated on a surface of a substrate, each of said amorphous nucleation sites being made of an aggregation of predetermined atoms, and a crystal layer covering the surface of the substrate and containing crystal grains growing from the nucleation sites.

29. Regarding these limitations, Lal as modified by Bertero and Okumura as set forth above clearly teaches the advantages of forming an amorphous Ti layer on the surface

of the substrate prior to forming the crystalline Cr underlayer. Further, Lal teaches that the Ti coating is preferably 50-200 angstroms thick (column 5, line 63-column 6, line 5).

30. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to form a 50angstrom thick Ti layer over the subtrate taught by Lal, as Lal specifically teaches that this is a suitable thickness for the Ti layer.

31. While Lal as modified by Bertero and Okumura does not teach the applicants requirement of a amorphous nucleation sites spaced apart from one another, it is the examiners position that this 50angstrom (5nm) thick layer meets this limitation, as the applicant in his arguments dated 7/28/03 admits that layers that are >10nm thick form continuous layers, which logically leads to the conclusion that layers less then 10nm thick are discontinuous. Thus, given this admission (which is echoed by the Okumura at column 5, lines 15-20), it is the examiners position that the 5nm thick it layer meets the applicants requirement of the formation of nucleation sites spaced apart from one another as it will be a discontinuous layer and thus necessarily have individual sites separated from one another.

32. Further, it is noted that the combination of Lal with Bertero and Okumura does not expressly teach the applicants limitation requiring a crystalline layer to be growing from the nucleation sites. However, given that Bertero teaches that sputter deposited layers epitaxially grow over layers on which they are deposited, and given that a crystalline Cr layer is deposited on the amorphous Ti layer, the examiner takes the position that this limitation is met.

33. Claim 23 requires at least the surface of the substrate to be amorphous. Lal teaches that the substrate can be made form materials such as glass, carbon, silicon, glass-ceramic, or ceramic (column 5, lines 40-52).

34. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a glass substrate as the substrate in Lal as modified by Bertero and Okumura, as Lal recognizes the equivalence of glass to the other materials listed as suitable for this purpose.

35. It is the examiners position that the limitations of claim 23 are met when a glass substrate is utilized, as glass is a known amorphous material.

36. The examiner acknowledges that Lal states that some substrates are initially formed as an amorphous glass and then heat-treated to form a crystalline ceramic phase. However, the examiner reads this passage in Lal as referring to the glass-ceramic type substrates listed as suitable, and not simply a glass substrate.

Response to Arguments

37. Applicant's arguments dated 12/18/2003 have been fully considered but are not persuasive.

38. The applicant's argument with respect to claims 1-4, 21-22, and 24-25 is unpersuasive. Essentially the gist of the applicant's argument is that the limitation "at least partly excluding a non-magnetic element from a lattice of the magnetic layer" or "at least partly excluding Cr atoms from a lattice of the magnetic layer" requires a non-magnetic element, i.e. Cr, to be *completely* excluded from at least a portion of the magnetic layer. This argument is not persuasive because the applicant's claim language

is open to a much broader interpretation. Namely, "at least partly excluding a non-magnetic element from a lattice of the magnetic layer" merely requires that at least some of at least one non-magnetic element be excluded from the lattice of the magnetic layer. This language can be read on by any magnetic layer, because: 1) it is highly unlikely that a magnetic layer will be made up of each and every non-magnetic element that is known; and 2) even if a magnetic layer were made up of such an alloy, any one of these elements are not required to be "completely excluded" and thus even if each and every non-magnetic element were present in the alloy it would be "at least partly excluded" to some extent. Thus, applicant's argument is not persuasive because it is not commensurate in scope with the claims.

39. Applicant's argument with respect to claims 5, 13, and 23 are unpersuasive as well. Applicant has traversed the examiners assertion that Ti layers that are less than 10nm thick will necessarily be discontinuous on the grounds that: 1) Lal does not disclose a discontinuous layer; and 2) forming a discontinuous layer depends on the material and thickness of the deposited layer and the surface tension between the deposited layer and the layer upon which it is deposited. It is noted that the examiner believes that applicant's statement that "while it is accurate that Ti may form a continuous layer at a thickness of approximately 1.0nm" contains a typo, in that applicant meant to argue 10.0nm, as opposed to 1.0nm. However, as will be explained below this has no impact on the result.

40. Applicants arguments enumerated above at section 29 are unpersuasive for the following reasons. First, the prior art, namely Okumura, states a column 5 lines 15-20

that sputter deposited Ti layers having a thickness >10nm are preferably formed so a continuous film is obtained. This logically infers that Ti layers having a thickness <10nm will be discontinuous. Bearing this in mind, Lal teaches the formation of a Ti underlayer between a Cr underlayer and a substrate, wherein the Ti underlayer can be 5nm thick (see Lal, column 6, lines 1-5). Thus, the examiner maintains that the Ti layer formed by Lal will be discontinuous in view of the teachings of the prior art and applicant's own admissions. Second, applicant's arguments in the instant response go against the applicant. Specifically, applicant has argued that the composition and thickness of a layer, as well as the surface tension between a deposited layer and the layer upon which it is deposited are crucial to obtaining a discontinuous film. Bearing this in mind, it is noted that the material in question (Ti) is the same in both Lal and Okumura. Further, the substrates in Lal are the same as the substrates of Okumura (see Lal, column 5, lines 40-51; and Okumura, column 3, lines 54-65). Thus, given the very strong inference in Okumura that Ti layers that are ≤10nm thick are discontinuous, applicant's argument actually supports the examiners position that the Ti layer of Lal as modified by Bertero and Okumura will be discontinuous because the composition of the Ti layer and the Substrate in Lal is the same as those taught by Okumura. Further, the thickness of the Ti layer in Lal is below the thickness of the Ti layer of Okumura, which as stated above presents a strong inference that a Ti layer that is less than 10nm is discontinuous.

41. Thus, for the reasons set forth above and because the applicant has not provided any evidence that a Ti layer that is less than 10nm thick is continuous, the applicant's arguments are not deemed to be persuasive.

Conclusion

42. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 571-272-1517. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul J. Thibodeau can be reached on 571-272-1516. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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